Notice of Allowability	Application No.	Applicant(s)	
	09/822,532	LEE, CHENG-WEI	
	Examiner	Art Unit	
	Robert M Kunemund	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *applicants' response of September 23, 2003*.
2. ☒ The allowed claim(s) is/are *1-20*.
3. ☒ The drawings filed on *3/1001* are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____.
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.
5. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
   (a) ☐ The translation of the foreign language provisional application has been received.
6. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. **THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

7. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
8. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No. ____.
   (b) ☐ including changes required by the proposed drawing correction filed _____, which has been approved by the Examiner.
   (c) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the margin according to 37 CFR 1.121(d).

9. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1☐ Notice of References Cited (PTO-892)
2☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No. _____
4☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5☐ Notice of Informal Patent Application (PTO-152)
6☐ Interview Summary (PTO-413), Paper No._____.
7☐ Examiner's Amendment/Comment
8☐ Examiner's Statement of Reasons for Allowance
9☐ Other

ROBERT KUNEMUND
PRIMARY EXAMINER

CLMPTO

12/11/2003

VA

1. A method for forming aluminum bumps by sputtering and chemical mechanical polishing comprising the steps of:

providing a pre-processed electronic substrate with a plurality of input/output (I/O) pads formed on a top surface;

depositing an insulating material layer on top of said plurality of I/O pads to a thickness that is substantially the thickness of Aℓ bumps to be formed;

photolithographically forming a plurality of openings with one on each of said plurality of I/O pads;

sputter depositing a metal comprising Aℓ filling said plurality of openings and covering a top surface of said insulating material layer;

chemical mechanical polishing said electronic substrate until a plurality of Aℓ bumps is formed with a top surface of the bump flush with said top surface of the insulating material layer; and

removing at least partially a thickness of said insulating material layer by a wet etch process.

2. A method for forming aluminum bumps by sputtering and chemical mechanical polishing according to claim 1 further comprising the step of forming said plurality of I/O pads in a metal comprising Aℓ.

3. A method for forming aluminum bumps by sputtering and chemical mechanical polishing according to claim 1 further comprising the step of depositing said insulating material layer of a thickness of at least 5 μm.

4. A method for forming aluminum bumps by sputtering and chemical mechanical polishing according to claim 1 further comprising the step of depositing said insulating material layer of a material selected from the group consisting of silicon oxide, spin-on-glass and polyimide.

5. A method for forming aluminum bumps by sputtering and chemical mechanical polishing according to claim 1 further comprising the step of depositing said insulating material layer by at least two layers of different materials.

6. A method for forming aluminum bumps by sputtering and chemical mechanical polishing according to claim 1 further comprising the step of depositing said insulating material layer by a first layer of Si_3N_4 or SiO_2 and a second layer of polyimide on top of said first layer.

7. A method for forming aluminum bumps by sputtering and chemical mechanical polishing according to claim 1 further comprising the step of depositing said insulating material layer by at least two layers of different materials to a total thickness of at least 5 μm.

8. A method for forming aluminum bumps by sputtering and chemical mechanical polishing according to claim 1 further comprising the step of depositing said insulating material layer by at least two layers of different materials to a total thickness between about 5 μm and about 10 μm.

9. A method for forming aluminum bumps by sputtering and chemical mechanical polishing according to claim 1 further comprising the step of sputter depositing a metal that consists of Aℓ and Cu.

10. A method for forming aluminum bumps by sputtering and chemical mechanical polishing according to claim 1 further comprising the step of sputter depositing a metal that consists of Aℓ and less than 3 wt. % Cu.

11. A method for forming aluminum bumps by sputtering and chemical mechanical polishing according to claim 1 further comprising the step of conducting said wet etch process incorporating buffered oxide etch (BOE).

12. (Amended) A method for forming aluminum bumps on a semiconductor structure comprising the steps of:

providing a pre-processed semiconductor structure with a plurality of I/O pads on top;

printing a layer of polyimide-containing material having a thickness of at least 5 μm on top of said structure;

forming a plurality of openings on each of said plurality of I/O pads exposed;

filling said plurality of openings with a metal comprising Aℓ;

removing excess metal from areas other than said plurality of openings; and

removing at least partially said layer of polyimide-containing material by a wet etch process.

13. A method for forming aluminum bumps on a semiconductor structure according to claim 12 further comprising the step of forming said plurality of I/O pads in a metal comprising Aℓ.

14. A method for forming aluminum bumps on a semiconductor structure according to claim 12 further comprising the step of printing said layer of polyimide-containing material by a screen printing or stencil printing technique.

15. A method for forming aluminum bumps on a semiconductor structure according to claim 12 further comprising the step of printing said layer of polyimide-containing material to a thickness between about 5 μm and about 10 μm.

16. A method for forming aluminum bumps on a semiconductor structure according to claim 12 further comprising the step of filling said plurality of openings with a metal comprising Aℓ and Cu.

17. A method for forming aluminum bumps on a semiconductor structure according to claim 12 further comprising the step of removing excess metal until a surface of said metal in the plurality of openings is flush with a top surface of said layer of polyimide-containing material.

18. A method for forming aluminum bumps on a semiconductor structure according to claim 12 further comprising the step of removing at least partially said layer of polyimide-containing material by an etchant comprising HF and NH_4F.

19. A method for forming aluminum bumps on a semiconductor structure according to claim 12 further comprising the step of removing at least ½ of a total thickness of said layer of polyimide-containing material to facilitate bonding to said Aℓ bumps formed in said plurality of openings.

20. A method for forming aluminum bumps on a semiconductor structure according to claim 12 further comprising the step of removing completely said layer of polyimide-containing material to facilitate bonding to said Aℓ bumps formed in said plurality of openings.